

SimpleLink™ Wi-Fi® SensorTag

The SimpleLink™ Wi-Fi® SensorTag from Texas Instruments™ (model CC3200SensorTag) provides a demo platform for showcasing the capabilities of the CC3200 device. With this easy-to-use platform, environmental sensing and other Internet of Things (IoT) applications can be done with ease.

The CC3200 device is part of the SimpleLink microcontroller (MCU) platform which consists of Wi-Fi®, Bluetooth® low energy, Sub-1 GHz and host MCUs. All share a common, easy-to-use development environment with a single core software development kit (SDK) and rich tool set. A one-time integration of the SimpleLink platform lets you add any combination of devices from the portfolio into your design. The ultimate goal of the SimpleLink platform is to achieve 100 percent code reuse when your design requirements change. For more information, visit www.ti.com/simplelink.

Contents

1	Introduction	2
1.1	CC3200 SensorTag	2
1.2	Key Features	2
2	Hardware Description	3
2.1	Block Diagram	3
2.2	Hardware Features	4
2.3	RF Function and Frequency Range	4
2.4	Sensors and Peripherals.....	4
3	Design Files	6
3.1	Hardware.....	6
4	PCB Revision.....	6
5	References	7

Texas Instruments, SimpleLink, Internet-on-a chip are trademarks of Texas Instruments.
 ARM, Cortex are registered trademarks of ARM Limited.
 Bluetooth is a registered trademark of Bluetooth SIG, Inc.
 Wi-Fi is a registered trademark of Wi-Fi Alliance.
 All other trademarks are the property of their respective owners.

1 Introduction

1.1 CC3200 SensorTag

The high-performance CC3200 device is the industry's first single-chip microcontroller (MCU) with built-in Wi-Fi connectivity for easy system application. Created for the Internet of Things (IoT), the SimpleLink™ Wi-Fi CC3200 device is a wireless MCU that integrates a high-performance ARM® Cortex®-M4 MCU that allows customers to develop an entire application with a single device. With on-chip Wi-Fi, internet, and robust security protocols, no prior Wi-Fi experience is needed for fast development.

The CC3200 SensorTag is a low-cost IoT demo platform for ARM® Cortex®-M4F-based microcontrollers. The SensorTag design highlights the [CC3200](#) Internet-on-a chip™ solution and Wi-Fi capabilities. The CC3200 SensorTag features programmable user buttons, LEDs, reed relay, digital microphone, and a buzzer for user interaction. Onboard sensors, gyroscope, accelerometer, and compass allow for easy environmental sensing and IoT applications. [shows the CC3200 SensorTag.](#)

1.2 Key Features

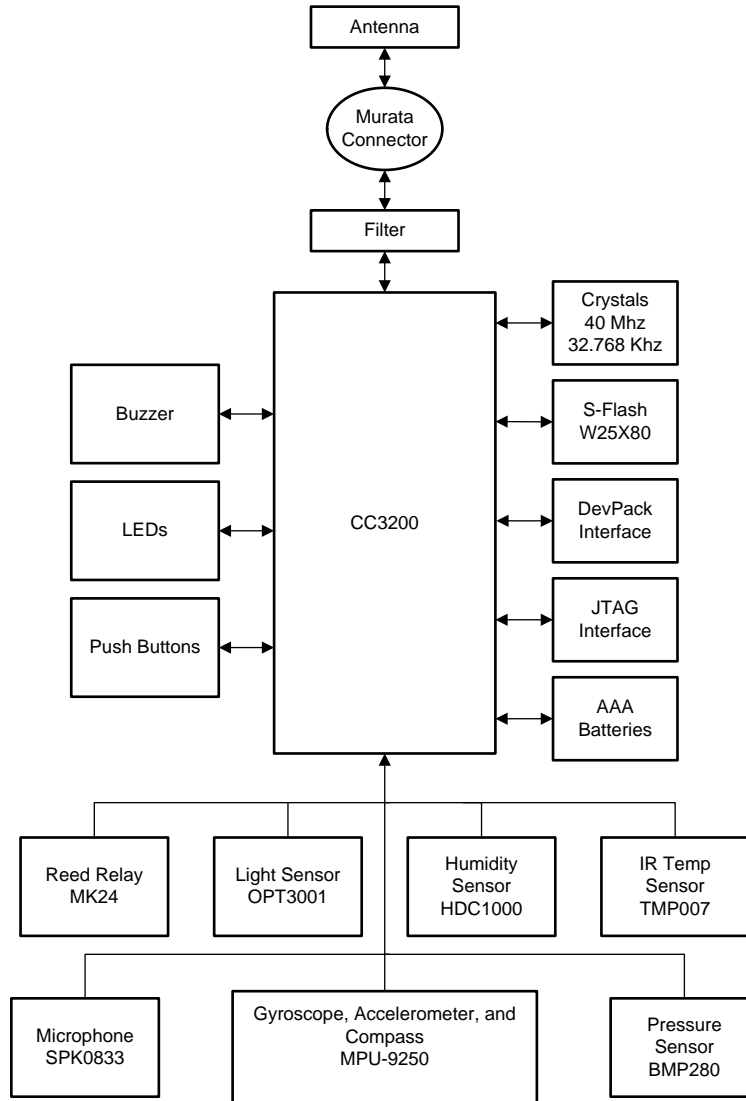
The key features of the CC3200 SimpleLink Wi-Fi and IoT SensorTag are as follows:

- CC3200, SimpleLink Wi-Fi, Internet-on-a chip solution with integrated MCU
- Onboard inverted-F antenna with RF connector for conducted testing
- Two buttons, two LEDs, reed relay, digital microphone, and a buzzer for user interaction
- Sensors, gyroscope, accelerometer, and compass for easy integration in IoT application
- Debug and JTAG interface for flash programming

2 Hardware Description

2.1 Block Diagram

Figure 1 shows a block diagram of the CC3200 SensorTag.



Copyright © 2017, Texas Instruments Incorporated

Figure 1. CC3200 SensorTag Block Diagram

2.2 Hardware Features

The hardware features of the CC3200 SensorTag are as follows:

- CC3200, SimpleLink Wi-Fi, internet-on-a chip solution with integrated MCU
- 20-pin DevPack SKIN connector and 10-pin JTAG connector
- Onboard inverted-F antenna with RF connector for conducted testing
- Two buttons, two LEDs, a reed relay, a digital microphone, and a buzzer for user interaction
- Gyroscope, accelerometer, and compass for easy integration in IoT application
- Debug and JTAG interface for flash programming
- AAA battery connector interface
- Infrared Thermopile Sensor, Pressure Sensor, Humidity Sensor, and Light Sensor
- Onboard 1-MB serial flash memory

2.3 RF Function and Frequency Range

The CC3200 SensorTag device is designed to operate in the WLAN 2.4-GHz band. The CC3200 SensorTag device also supports Channels 1 through 11 (2142 MHz to 2462 MHz). The SensorTag design uses the SimpleLink Wi-Fi CC3200 Internet-on-a chip device (see [CC3200 SimpleLink™ Wi-Fi® and IoT SensorTag Design Files](#)).

NOTE: The maximum RF power transmitted in each WLAN 2.4-GHz band is 16.5 dBm (EIRP power).

2.4 Sensors and Peripherals

2.4.1 Reed Relay

The MK24-A reed relay is good for low-power operations (see [1]). The reed relay is suitable for IoT applications with a contact resistance of 350 MΩ, a maximum operating time of 0.25 ms, and a release time of 0.15 ms.

2.4.2 Digital Microphone

The SPH0641LU4H device is suitable for a varying range of applications; it provides a means for sensing sounds (see [2]). The SPH0641LU4H is a low-power microphone with high performance and good RF immunity. The microphone can be operated in the five modes that follow:

- Powered down mode, VDO = 0 V
- Sleep mode, VDO ranges from 3.6 V to 1.62 V
 $f_{\text{CLOCK}} \leq 250 \text{ kHz}$
- Low-power mode, VDO ranges from 3.6 V to 1.62 V
 $351 \text{ kHz} \leq f_{\text{CLOCK}} \leq 815 \text{ kHz}$
- Ultrasonic mode, VDO ranges from 3.6 V to 1.62 V
 $3.072 \text{ MHz} \leq f_{\text{CLOCK}} \leq 4.8 \text{ MHz}$
- Standard performance mode, VDO ranges from 3.6 V to 1.62 V
 $1.024 \text{ MHz} \leq f_{\text{CLOCK}} \leq 2.475 \text{ MHz}$

2.4.3 Buzzer

The HCS0503B device can be used as an alarm (see [3]). Some of the specifications follow:

- Rated voltage of 3 V
- Output S.P.L $\geq 80 \text{ dB}$
- Coil resistance of $12 \Omega \pm 3$

- Rated frequency of 4000 Hz

2.4.4 Gyroscope, Accelerometer, and Compass

The MPU-9250 device is a multichip module consisting of a 3-axis gyroscope, a 3-axis accelerometer, and a 3-axis magnetometer for position tracking (see [4]). The MPU-9250 features three 16-bit ADCs each for the gyroscope, accelerometer, and magnetometer. Some other features of the MPU-9250 are as follows:

- High-precision clock
- Precision tracking of fast and slow motions
- VDD operating range of 2.4 V to 3.6 V
- I2C and SPI serial communication interface

2.4.5 Infrared Thermopile Sensor

The TMP007 device is a fully-integrated microelectromechanical system (MEMS) thermopile sensor that measures the temperature of an object without direct contact (see [5]). The thermopile absorbs passive infrared energy from an object at wavelengths of 4 μm to 16 μm within the end-user defined field of view. Some other features are as follows:

- 14-bit local temperature sensor for cold junction reference
- Two-wire serial interface options
- Low power

2.4.6 Pressure Sensor

The BMP280 device is a digital pressure sensor for measuring barometric pressure conditions (see [6]). The BMP280 can also be used to determine altitude. Some other features of the sensor include the following:

- Wide pressure range of 300 hPa to 1100 hPa
- High accuracy
- Low current consumption of 2.7 μA @ 1 Hz sampling rate
- I2C and SPI serial communication interface

2.4.7 Humidity Sensor

The HDC1000 device is a digital humidity sensor with a relative humidity (RH) operating range of 0% to 100% that provides excellent measurement accuracy at very low power (see [7]). Some other features are:

- Relative humidity accuracy $\pm 3\%$
- 14-bit measurement resolution
- Supply voltage range of 3 V to 5 V

2.4.8 Light Sensor

The OPT3001 device is a sensor that measures the intensity of visible light (see [8]). The device can sense a light spectrum similar to that of the human eye. Some other features follow:

- Measurements: 0.01 lux to 83k lux
- Wide power-supply range: 1.6 V to 3.6 V
- Low operating current: 1.8 μA
- Flexible interrupt system

3 Design Files

3.1 Hardware

All design files include schematics, layout, bill of materials (BOM), Gerber files, and documentation. All documentation materials are available for download from [SimpleLink Wi-Fi CC3200 LaunchPad Reference Design](#).

4 PCB Revision

PCB Revision	Description
Rev 1.2	Baseline

5 References

1. [MK24 Series Reed Sensor](#)
2. [Knowles SPH0641LU4H Digital Microphone](#)
3. [HCS0503B Buzzer](#)
4. [MPU-9250 Nine-Axis \(Gyro + Accelerometer + Compass\) MEMS MotionTracking™ Device](#)
5. [TMP007 Infrared Thermopile Sensor with Integrated Math Engine Data Sheet](#)
6. [BMP280 Barometric Pressure Sensor](#)
7. [HDC1000 Low Power, High Accuracy Digital Humidity Sensor with Temperature Sensor Data Sheet](#)
8. [OPT3001 Ambient Light Sensor \(ALS\) Data Sheet](#)
9. [Watch DevPack](#)
10. [SimpleLink Wi-Fi CC3200 LaunchPad Reference Design](#)
11. [CC3200 SimpleLink™ Wi-Fi® and IoT SensorTag Design Files](#)

Revision History

Date	Revision	Notes
February 2017	SWRU514*	Initial release

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ("TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>), [evaluation modules](#), and [samples](http://www.ti.com/sc/docs/sampterm.htm) (<http://www.ti.com/sc/docs/sampterm.htm>).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2017, Texas Instruments Incorporated